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SCIENTIFIC AFFAIRS

No. 548

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No. 548

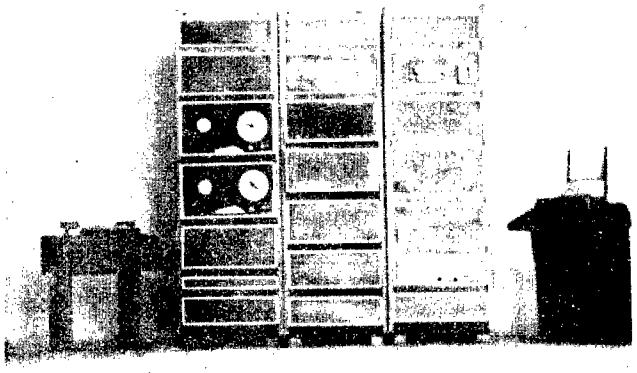
CONTENTS PAGE

SPECIFICATIONS OF 'IZOT-0310' ELECTRONIC COMPUTER

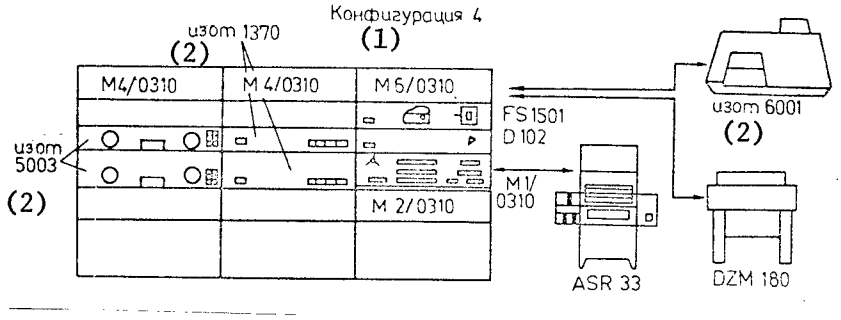
Sofia VOENNA TEKHNIKA in Bulgarian Vol 11 No 1 ,Jan 77 p 17

[Unattributed article: "Small-Sized 'IZOT-0310' Electronic Computer System"]

[Text] At the 32d International Fair in Plovdiv the Bulgarian "IZOT-0310" electronic computer system (configuration 4) received a gold medal. It is a small-sized general-purpose digital electronic computer of wide application. It is designed on the modular principle.



The "IZOT-0310" system has high-speed working storage with a large diversity of instructions that assure high efficiency and the possibility of equipping with various peripherals, magnetic-disk and magnetic-tape storage, punched-card and punched-tape reader, punched-card punched-tape, wide-page printing etc.



Key:

1. Configuration 4
2. IZOT

The system has abundant software designed to meet the needs of the mass consumer of computer equipment.

It is suited for use in bookkeeping and accounting operations, warehousing, administrative and economic activities, instruction, laboratory research in scientific-research and planning institutes, production process control, multipurpose communications-oriented information systems, processing of commercial information and control of commercial activity.

Brief Technical Description

Central processor: parallel single-address machine with fixed word length; 12-bit machine word with additional bit for odd parity check; execution of operations by binary arithmetic in complement form; speed: 250,000 additions per second; more than 200 instruction-commands can be used, depending on configuration; direct and indirect addressing is used; autoindex addressing is achieved by eight-index registers, which gives great facility in programming.

Working storage: ferrite memory made in blocks with capacity of 4096 /4K/12+ 1 bit words; total capacity: 32,000 words (32K) -- eight blocks each of 4K; memory cycle: 2 microseconds.

Input-output exchange: The "IZOT-0310" system has two channels for data exchange, namely, a channel for program-controlled exchange with maximum speed of up to 110,000 words per second and a channel for direct storage access with speed of up to 500,000 words per second; input-output channels permit exchange with 64 different peripherals.

The system is supplied in five different configurations, depending on the consumer's needs.

Configuration No. 4: module 1 ("IZOT-0310/M1" minicomputer) -- 1 each; module 2 (expansion of working storage to 32K words with check bit) -- 1 each; module 3 (control unit for minidisk storage with interchangeable packet and flying magnetic heads) -- 1 each; module 6 (control unit for "IZOT-6001" card reader and control unit for wide-page printing) -- 1 each; module 4 (control unit for series of minimagnetic tapes) -- 1 each; DZM-180 series mosaic printer -- 1 each; "IZOT-5003 E" mini ZUML [magnetic-tape storage units] -- 2 each; "IZOT-1370" mini ZUMD [magnetic-disk storage units] -- 2 each; "IZOT-6001" card reader -- 1 each; "IZOT-0310" cabinets -- 3 each.

Software: punched-tape operational system (POS-310); system of programs for expansion of arithmetic (programs for calculation with integers, transcendental functions, binary-decimal arithmetic, floating-point operation etc.); FORTRAN, FOKAL, program assembler language (PAL); symbolic assembler for binary distributed programs (SABD); FORTRAN-SABD library; debugging programs; editor; macro- and microtranslators, reassemblers etc.

Disk operational system (DOS-310) makes possible preparation, translation, debugging and execution of the user's programs. It is oriented towards file processing and makes possible normal input-output operations with all units of the "IZOT-0310" system.

Disk storage is mandatory for operation of DOS-310.

Basic programs of the system are: DOS-310 generation program; monitor program for control of the operation of the operator panel system; program for loading user's programs; edit program for preparation of programs; program providing for exchange of information between individual input-output units; assembly program for translation of user's programs; other service and auxiliary programs.

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BULGARIA

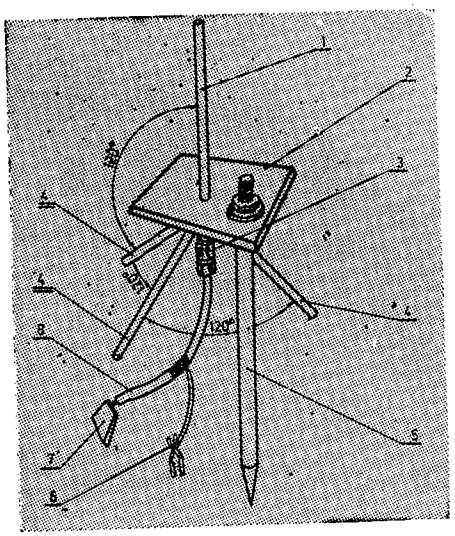
SPECIAL ANTENNAS DESCRIBED

Sofia VOENNA TEKHNIKA in Bulgarian Vol 11 No 1,Jan 77 p 29

[Article by Major Georgi Milev: "'Arched-Shelter' Receiving and Transmitting Antenna"]

[Text] Under modern conditions of conducting combat activity, aviation equipment will have to be sheltered and made ready in reinforced-concrete shelters (arched shelters). Aircraft will emerge from these when necessary, for which reason there will have to be reliable communication with the command post and between aircraft themselves.

Regular antennas do not permit stable communication because the reinforced-concrete structures of the shelters screen radiowaves. Besides, if the sword-shaped antenna of the radio station and the open-type antenna for ARK [automatic radio compass]-5 are used, aircraft personnel will not be able to hear the signals of the homing station or adjust the automatic radio compass.



These difficulties are overcome by using the special antenna shown in the figure.

The antenna is a quarter-wave vibrator (1) 4-6 mm in diameter, which can be of steel or copper wire. A peg is welded to the lower end of the active vibrator in order to hold the coaxial feeder. The antenna counterpoises (4), positioned at an angle of 120° to each other, are fastened to the lower end above the peg, as shown in the figure. Their purpose is to increase the virtual height of the active vibrator. The counterpoises and the vibrator are set on a bakelite or plexiglas plate (2) and fastened with bolts. Made fast to the same plate is antenna holder 5, which is driven into the ground above the arched shelter.

Experiments have shown that reliable communications in the region of the airfield can be provided with aircraft in the air approximately 30-40 km away. This fully meets requirements for their control by the command post.

Lest great attenuation result, the antenna lead 8 must not be more than 20 m long (for cable RK-47). If a 30-m long antenna lead is used (feeder with wave resistance of 50 Ω), due to incommensurability with the wave length the energy of the electromagnetic field decreases by 10 percent as compared with that obtained with regular antennas.

To set up operations, the antenna is placed on (driven into) the layer of earth above the shelter. The antenna lead is passed through the door or ventilation vents and connected, via cap 7, with the blade antenna of the radio set. Cable 6 is connected by a clamp with the aircraft body, thus assuring maximum utilization of the antenna's virtual height.

When the aircraft emerges from the shelter, the cap pulls off the antenna and the aircraft takes off. When aircraft is put in arched shelters, an aircraft technician puts on the cap, whereupon the antenna is ready for operation.

To make the antenna, materials are needed which can readily be found in air units, such as steel or copper wire 4-6 mm in diameter, Getinaks or textolite 10/6 cm, two connecting pegs, coaxial feeder with 50-Ω wave resistance (screened telephone cable with approximately the same resistance can also be used), concrete or other iron for antenna holder -- 1.3 m.

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NEW PLASTIC LUBRICANTS DESCRIBED

Sofia VOENNA TEKHNIKA in Bulgarian Vol 11, No 1, Jan 77 pp 6-8

[Article by Engineer Lt Col Petko Georgiev, and Candidate of Chemical Sciences Engineer Col Georgi Grigorov: "New Plastic Lubricants Used in Our Country"]

[Text] In the past few years many new plastic lubricants have been created to lubricate critical rubbing joints in air, land and marine equipment in order to preserve and pack various parts and machines. The planning and proper use of these are significantly hindered by the lack of specific data on their properties, their good points and shortcomings, and the possibilities of assuring the normal operation of various components and mechanisms. These difficulties are intensified by the fact that all the new lubricants are produced in the USSR, whence they are imported into our country.

To facilitate the work of various specialists in the planning, procurement and use of these lubricants, as well as in the operation of different equipment, we shall consider some of the ones that are more widely used in Bulgaria. Of particular interest are the multipurpose lubricants.

They can be used to lubricate all basic rubbing joints and mechanisms. They are therefore sometimes called multifunctional or general-purpose. They are water-resistant and efficient in a wide temperature range, at different speeds and loads. Multipurpose lubricants cannot be substituted for some kinds of antifriction lubricants, such as those stable in a corrosive environment or low-temperature and instrument lubricants. All general-purpose lubricants are being successfully replaced by a type of solid oils, lubricants designed to operate at higher temperatures (sodium lubricants, sodium-calcium lubricants of the 1-13 type, lithium lubricants), some industrial and many other lubricants. The following multipurpose lubricants are used in Bulgaria:

LITOL-24 (TU [Technical Specifications] 38 101139-71)

This is a soft cherry-colored product. Undyed batches are brown, which is the kind most often imported into Bulgaria. Litol-24 and the lubricants of the Fiol series are made by condensing a mixture of naphthene oils with lithium 12-hydroxystearic acid soap. Litol-24, like all lithium lubricants, is water-resistant even in boiling water. The high dropping point, low volatility of the dispersion medium and comparatively high ultimate strength permit the use of these lubricants at a temperature of 383-403° K (110-130° C). Working efficiency is retained to 233° K (-40° C), and in many high-power mechanisms to even lower temperatures. It possesses good mechanical and colloidal stability, and the presence of an antioxidant additive gives it high chemical stability. The anti-jamming characteristic of the lubricant is satisfactory. It can be used in all types of rubbing components: in sliding and rolling-contact bearings, in link, gear and other transmissions for the lubrication of rubbing surfaces. The lubricant has good preservative properties and provides reliable anticorrosion protection for metal pieces. Litol-24 is most often used today as a general motor-vehicle lubricant. It can also be widely used in road-building, agricultural, electrical and many other types of machinery. Operational tests have shown that it is advisable to use it in the mechanisms of heavy-duty chain-type machines, excavators, ship machinery, and in aircraft landing-gear bearings. Litol-24 successfully replaces all types of solid oils, general-purpose sodium and lithium greases, as well as some other plastic lubricants. This substitution has great economic effect. Despite the fact that the price of Litol-24 is high in comparison with that of other lubricants, lubricating costs are low and working time in rubbing components is prolonged.

FIOL-1 (TU 38 101141-71)

This lubricant is very soft. It resembles Litol-24 in composition and principal characteristics. Due to lower thickener content it has a lower viscosity and ultimate strength and softer consistency, but better frost-resistance. It is used in some components of VAZ motor vehicles: components lubricated with pressure lubricator in the steering system etc. In many cases Fiol-1 can be replaced by Litol-24.

FIOL-2 (TU 38 101142-71)

It resembles Litol-24 in composition and principal characteristics, but is softer. It is designed to lubricate various components in industrial machinery operating under light and medium loads and at a temperature up to 337° K (100° C). It is used in rolling-contact and sliding bearings, in low-power gear reduction units, in lathes, conveyors and other analogous devices. In many cases it can be replaced by Litol-24.

FIOL-3 (TU 38 101143-71)

A soft green-colored lubricant. Undyed lots have a brown color. It is practically identical in composition and principal characteristics with Litol-24. This lubricant is designed for and is used in the same cases as Fiol-2. Due to denser consistency and higher ultimate strength, it stands up better in rubbing components.

FIOL-2M (TU 101233-72)

A soft silver-red lubricant. In composition it resembles other lubricants of the Fiol series. The presence of a viscous and adhesive, as well as antioxidant additive improves its operating qualities. In addition, it contains 2% highly-refined molybdenum disulfide (MoSi). It is used to lubricate the shafts of the octane selector of VAZ motor vehicles. It can also be used in various rubbing components of industrial machinery and transport vehicles where a lubricant containing an antifriction additive is necessary.

High-temperature lubricants are used in very critical machinery and parts of military equipment.

This group includes lubricants which are efficient at a temperature of 473-523° K (200-250° C) and higher. They are produced from synthetic oils and special thickeners. New high-temperature lubricants are the following:

UNIOL-1 (TU 38 Ukrainian SSR 201150-73)

It is a soft dark-brown lubricant. In composition it belongs to the calcium-complex lubricants. The thickener is made from plentiful animal fat.

Uniol-1 is water-resistant even in boiling water. In high-temperature properties it is not inferior even to the lubricant NK-50: it has a high dropping point, insignificant variation of ultimate strength with increase of temperature, and low volatility. Its colloidal stability is good. The lubricant does not give off oil during storage over a 3- to 5-year period. It has good anti-jamming characteristics, which is especially important in the operation of heavily loaded mechanisms (gear drive, chains, universal joints etc.). The shortcomings of Uniol are its tendency towards condensation and its hygroscopicity, necessitating its storage in hermetic containers. Uniol-1 can be used for different cases, for example, as a general motor-vehicle lubricant in place of solid oils, lubricant 1-13, YaNZ-2, technical petroleum jellies etc. It is most practical to use this lubricant in rubbing components that operate at high temperatures of 423° K (up to 150° C). It is about 100 times cheaper than low-temperature lubricants of synthetic oils such as TsIATIM [Central Scientific Research Institue of Aviation Fuels and Lubricants]-221, VNII NP [All-Union Scientific Research Institute of the Petroleum Industry]-207 etc.

VNII NP-207 (State Standard 19774-74)

This lubricant is similar in composition and properties to TsIATIM-221. It contains synthetic hydrocarbon oil in addition to polysiloxane liquid, for which reason it is superior to TsIATIM-221 in respect of length of operation in rolling-contact bearings at a temperature of 423-453° K (150-180° C). A certain shortcoming of the lubricant is its inadequate resistance to cold. It is used chiefly in the bearings of electrical machinery that operates up to 423-453° K (150-180° C).

VNII NO-231 (TU 38 101173-71)

This is a soft red-colored lubricant produced by the condensation of polysiloxane liquid with DG-100 carbon black. In respect of composition and characteristics it occupies a position midway between plastic lubricants and semiliquid pastes. It is efficient at 250° C. Prolonged heating at 423-523° K (150-250° C) causes thermal thickening and sharp deterioration of its mechanical stability. The lubricant has good resistance to cold and anti-jamming properties. This permits it to be used in worm reduction gear and threaded transmissions. It can also be used in low-speed rolling-contact and sliding bearings. It is used chiefly in aviation.

GRAFITOL (TU 38 201172-74)

This is a soft red-colored lubricant. It does not melt even at a temperature over 523° K (250° C), which is due to the thickener, silica gel. It has low volatility and satisfactory water-resistance. It is used principally for high-temperature rubbing components of industrial equipment, for example, the mechanisms of drying-chamber doors, the bearings of hot-air ventilators etc.

AEROL (TU 38 201171-74)

In composition, this lubricant resembles grafitol, but contains MoSi instead of graphite. A high concentration of MoSi significantly improves its anti-jamming properties. In its basic indicators, it is like grafitol. It can be used in rubbing components of industrial machinery operating at a high temperature.

For components and parts operating at low temperatures, low-temperature lubricants are used.

These are designed for the lubrication of components at low temperatures of 223° K (-50° C). They are made by thickening the oils MVP, velocite etc., low-viscosity liquids, with natural-fat soaps or with solid hydrocarbons.

GOI-54p (State Standard 3276-74)

This is an improved low-temperature lubricant consisting of a soft, yellow or light-brown petroleum jelly. It is made by thickening low-viscosity oil with ceresine and the additive MNI-7. It is superior to other low-temperature lubricants in water-resistance, colloidal and chemical stability. It is used for the corrosion-proofing of machinery and instruments for a period up to five years. In contrast to other hydrocarbon lubricants, it is easily applied to surfaces in unmelted form by smearing. It has found wide application as an antifriction artillery lubricant. TsIATIM-201 can be substituted for it, but the former has poorer protective properties.

Instrument lubricants are also of interest for specialists.

VNII NP-274 (State Standard 19337-73)

This is a high-quality instrument lubricant. Due to its low volatility it can be used in a high vacuum up to 10^{-7} mm Hg. It is efficient up to 193° K (-80° C). It is made by thickening polychlorosiloxane liquid with lithium 12-hydroxystearic acid soap. It is intended for miniature-instrument rolling-contact bearings and small reduction gear operating in a high vacuum. It is efficient at high speeds up to 30,000 rpm. It is used in microelectric machinery, precision machinery and instruments. It is advisable to use it only in cases where other cheaper and available instrument lubricants cannot provide reliable operation of the instrument.

ATs-1, ATs-2, ATs-3 (TU 38 101383-73)

These are optical lubricants for lubricating the rubbing surfaces of threaded joints, tooth and worm gear of binoculars, theodolites etc. They are efficient in a temperature range from 223-338° K (-50° C to +65° C). They have good water-resistance and colloidal and chemical stability.

KRON 1, 2 and 3 (TU 38 101125-71)

In purpose and principal characteristics they resemble ATs lubricants, but have better antiwear and anti-jamming properties. They are used for eyepieces with multiple thread.

ORION (TU 38 101124-71)

It is applied to the internal surface of optical components to trap dust, small particles of paint, and corrosion products in order to prevent their getting into the lenses of the instrument. It is made on a base of vacuum oil, which permits use of the lubricant at sufficient pressure up to 10^{-4} mm Hg.

The principal indicators of the new plastic lubricants here considered are given in the table.

A № по ред	B Показатели	C Литол-24	D Фиол-1	E Фиол-2	F Фиол-3	G Фиол-2 м	H Униол-1	I ВНИИ НП-207	J ВНИИ НП-231	K Аерол	L Графитол	M ГОИ-54п	N ВНИИ НП-274	O АЦ-1	P АЦ-2	Q АЦ-3	R Крон-1	S Крон-3	T Орион
1	Пенетрация	235—250	310—340	265—295	220—260	265—295													
2	Температура на прокапване, не по-ниска от °С	185	185	185	190	180	200	250	—	—	—	60	190	100	100	100	180	180	180
3	Предел на якост, по-ниска от: — при 80°С	1.5	1	1.2	2	1	1.5—4	0.7	1	2—5	2—6	0	1.5—2	6	4—6	1.5—4	—	1—3	2—3
	— при 50°С	4—6	2.2—2.5	2.2—2.5	4—6	3—4.5	2.5—6	2—2.5		2—5	2—6	1.5 (40°С)	1	6	5	3	3.8	2—6	4—6
4	Колоидна стабилност, % не повече от	12	25	16	12	15	10	7	8	4	4	15	20	12	15	15	12	28	6
5	Вискозитет: — при —30°С	8—15 000	—	—	17000	—	—	—	—	—	—	11 000	≤550	5000	2400	3500	1200	6500	20 000
	— при 0°С, не по-вече от	2800	2000	2500	3000	2500	1600	2000	700	7000	6000	1100	900	640	600	1300	760	3000	5000
	— 20°С, не по-малко от	800	500	800	1000	800	400	800	250	1000	1500	300	—	350	350	850	300	1300	3000
6	Термоуплътняване при 120°С за 1 h, %	10—50	10—50	10—50	10—20	10—30	≤300 (200°С)	≤30 (200°С)	≤250 (200°С)	10 (200°С)	170 (200°С)	—	60—100	—	—	380	—	40	125
7	Изпаряемост при 150°С за 1 h, % .	≤10	10—12	10—12	10—12	10—12	60 (300°С)	≤45 (300°С)	≤30 (300°С)	—	≤47 (300°С)	≤30	0.9	1	1.2	4.5	1	4.2	0
8	Окисляемост при 120°С за 10 h/mg KOH/1 g смазка	0.5—1.5	1—1.5	0.8	0.8	0.8	0.2-0.8	0,4	—	—	—	0.2 (55°С)	—	—	—	—	—	—	—
9	Противозадирни свойства: — натоварване на заяждане . . .	≥30	60—80	60—80	≥30	90	80-100	42	34	100	90-110	10—60	—	—	—	—	—	—	—
	— натоварване на заваряване, . .	≥140	120—140	120—140	≥140	180—200	300	178	251	315	355	110	—	—	—	—	—	—	—
10	Температурен интервал на употреба, °С	От—40 до 130	От—40 до 120	От—40 до 120	От—40 до 130	От—40 до 120	От—30 до 150	От—60 до 180	От—30 до 250	От—15 до 160	От—15 до 160	От—30 до 50	От—80 до 130	От—50 до 65	От—30 до 65	От—30 до 65	От—50 до 60	От—30 до 60	От—60 до 60
	11 Заменители	Фиол-3	Фиол-2 литол-24	Фиол-3 литол-24	Литол-24	Литол—24 с 24 M_oS_2	Литол-24	ЦИАТИМ-221	—	Графитол	Аерол								
12	Срок за съхранение, г. не повече от	5	5	5	5	5	3	5	5	5	5	10	3	10	10	10	10	10	10

Key to Table:

A. Serial Number

B. Indicators

1. Penetration
2. Drop point, not lower than °C
3. Ultimate strength, not less than
   -- at 80° C
   -- at 50° C
4. Colloidal stability, % no more than
5. Viscosity
   -- at -30° C
   -- at 0° C, no more than
   -- 20° C, not less than
6. Thermal thickening at 120° per hr, in %
7. Volatility at 150° per hr, in %
8. Oxidizability at 120° C in 10 hr/mg KOH/g lubricant
9. Anti-jamming properties:
   -- loading of jamming
   -- loading of welding
10. Use temperature range, °C
11. Substitutes
12. Storage life, in years, no more than

C. Litol-24

10. From -40 to 130
11. Fiol-3

D. Fiol-1

10. From -40 to 120
11. Fiol-2

E. Fiol-2

10. -40 to 120
11. Fiol-3, Litol-24

F. Fiol-3

10. From -40 to 130
11. Litol-24

G. Fiol-2 M

10. From -40 to 120
11. Litol-24 with 24 MoS_2

Key to Table (continued):

H. Uniol-1

10. From -30 to 150
11. Litol-24

I. VNII NP-207

10. From -60 to 180
11. TsIATIM-221

J. VNII NP-231

10. From -50 to 250

K. Aerol

10. From -15 to 160
11. Grafitol

L. Grafitol

10. From -50 to 160
11. Aerol

M. GOI-54p

10. From -50 to 50

N. VNII NP-274

10. From -80 to 130

O. ATs-1

10. From -50 to 65

P. ATs-2

10. From -60 to 65

Q. ATs-3

10. From -60 to 65

R. Kron-1

10. From -50 to 60

Key to Table (continued):

S. Kron-3

10. From -60 to 60

T. Orion

10. From -60 to 60

6474
CSO: 2202

DEVELOPMENT OF NONCONVENTIONAL TOOLING PROCESSES EXAMINED

Bucharest CONSTRUCTIA DE MASINI in Romanian No 2-3, Feb-Mar 77 pp 69-77

[Article by Dr Ion Roman, of the Research and Design Institute for the Machine Building Industry (ICPTCM), Bucharest]

[Excerpt] Considering the specific conditions of our industry, moderate development will occur in the use of laser, electron beam, ion, photon, and ultrasonic installations. Their dissemination in industry will depend on the extent to which research will find applications where these processes can prove their effectiveness. In light of the above, in 1976-1980 less research will need to be directed toward the construction and diversification of installations, but more effort will have to be oriented toward finding new uses for existing installations or for installations which are still to be built, toward improving their performance (accuracy, surface quality, productivity, and so on), and toward a better understanding of the detailed phenomena of the processes.

4. Situation of Nonconventional Processes in Romania

As in other countries, the spark erosion process is the most widespread one. It is presently used primarily for tooling, die making, molds, models, and so on. The main branches which benefit from the use of spark erosion machines are the machine building and electromechanical industries, the light industry, and others. In 1975, the inventory of spark erosion machines -- most of them imported between 1968 and 1976 -- represented 0.12 percent of the total number of machine-tools. Over 70 percent of them are used in machine building and electromechanics.

The introduction of the spark erosion process in Romanian machine construction was hindered by several factors, the more important of which were:

The absence of domestic fabrication of such machines;

Insufficient awareness of the process on the part of industry;

High cost of the machines and importation difficulties in recent years.

Electrochemical, laser, and ultrasonic processes need to be further developed in the next time period. This need is included in the joint comprehensive program and in the programs of each of the departmental institutes and of the higher education.

The research and promotion of nonconventional machining processes has been pursued for several years already at the Traian Vuia Polytechnic Institute of Timisoara, the University of Brasov, and more recently at the Bucharest Polytechnic Institute, ICPTCM, and ICPE (Research and Design Institute for the Electrical Engineering Industry) in Bucharest. In the laser field, it is IFA (Institute of Atomic Physics) which has so far gained valuable experience in fabricating a number of installations for various purposes.

Considering this potential and the fact that nonconventional processes need to be strongly developed, a comprehensive program has been financed, aimed at research, design, execution, and adoption of prototypes of spark erosion and electrochemical machines, as well as of laser installations, which would be competitive with similar machines manufactured in industrialized nations, and which in the years to come will be introduced in mass production; this approach would thus facilitate the dissemination of nonconventional machining processes in our industry. At the same time, research projects are being undertaken to cause a more rational utilization of the existing machine inventory, as well as to improve working techniques, including those involving ultrasonics and electron and ion beams.

As a result of this program, in 1975, ICPTCM and ICPE produced an experimental model and a prototype of a spark erosion machine, type ELER-01 equipped with a 50 A generator, type GEP 50 F. This machine (figure 3), whose specifications are given below, was placed into mass production during 1976.

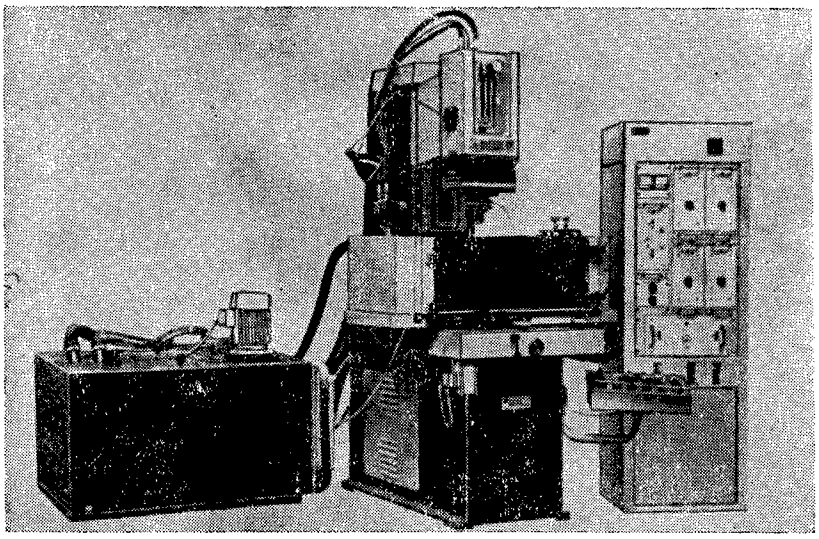

Figure 3. ELER-01 spark erosion machine.

Specifications for ELER-01 Spark Erosion Machine

Table dimensions	600 x 400 mm
travel	450 x 230 mm
motion accuracy	0.005 - 0.002 mm
Work tank, internal dimensions	925 x 500 mm
Head, electrode support dimensions	300 x 180 mm
automatic travel	200 mm
mechanical travel of ways	300 mm
maximum piston load	500 kg
Dielectric circulation installation,	
tank capacity	460 l
capacity of electrostatic filter	140 l
filter fineness	3 µm
GEP 50 F generator, type	controlled pulse
Current at sparking voltage, maximum	50 A
minimum	3 A
Number of current steps	16
Stepping difference	3 A
No-load voltage	90 V
Pulse duration	2 - 1800 µs in 12 steps
Pause duration	2 - 1800 µs in 12 steps
Operating polarity	positive (+), negative (-)
Finishing generator, no-load voltage	250 V
energy levels	0.06 - 0.13 mJ
power	250 VA
Maximum productivity for 50 A generator	400 mm^3/min
Surface finish	0.4 - 20 µm

Also in 1975, ICPTCM, together with ICPE and IFA finalized their prototype installations for electrochemical and laser deburring processes.

These achievements were also complemented by projects in higher education institutes, particularly at Timisoara and Brasov, which solved problems of nonconventional machining techniques and tooling for various enterprises in the machine building industry.

The joint program mentioned earlier has successfully concentrated all our available forces to disseminate nonconventional technology in the machine building industry, as well as to exploit and introduce new techniques and tools in the industry as a whole.

11,023
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LASER UTILIZATION IN TOOLING PROCESS ADVANTAGEOUS

Bucharest CONSTRUCTIA DE MASINI in Romanian No 2-3, Feb-Mar 77 pp 148-156

[Article by Eng Rodica Geogloman and Tech Carol Romak, of the Research and Design Institute for the Machine Building Industry (ICPTCM), Bucharest]

[Excerpt] 3. Romanian-Designed Laser Processing Installations

A modern industry of international caliber must introduce new technologies, methods, and equipment, with high productivity, and especially with the most advanced technical performances. With this idea in mind, the following considerations were used by us in designing a laser:

International utilization of the laser as a function of its principal properties;

Romanian achievements in building lasers;

Meeting the processing needs of the Romanian industry.

Using the research conducted in Romania in the field of lasers, Romanian-designed laser installations were built for processing purposes. The results obtained match the performance of similar installations built throughout the world. Following is a brief presentation of the principal technical specifications of the LASEROM-01 installation:

Active element: Nd-doped glass
Excitation lamp: Xenon discharge tube
Emission wavelength: 1.06 um
Maximum usable energy of laser beam: 10 J
Laser pulse duration: 0.3 - 1 ms (for drilling)
1 - 2 ms (for welding)
Condenser voltage (continuously variable): 0.9 - 3 KV
Operation: Manual: pulse by pulse, controlled by pedal or button
Automatic: with pulse programmer

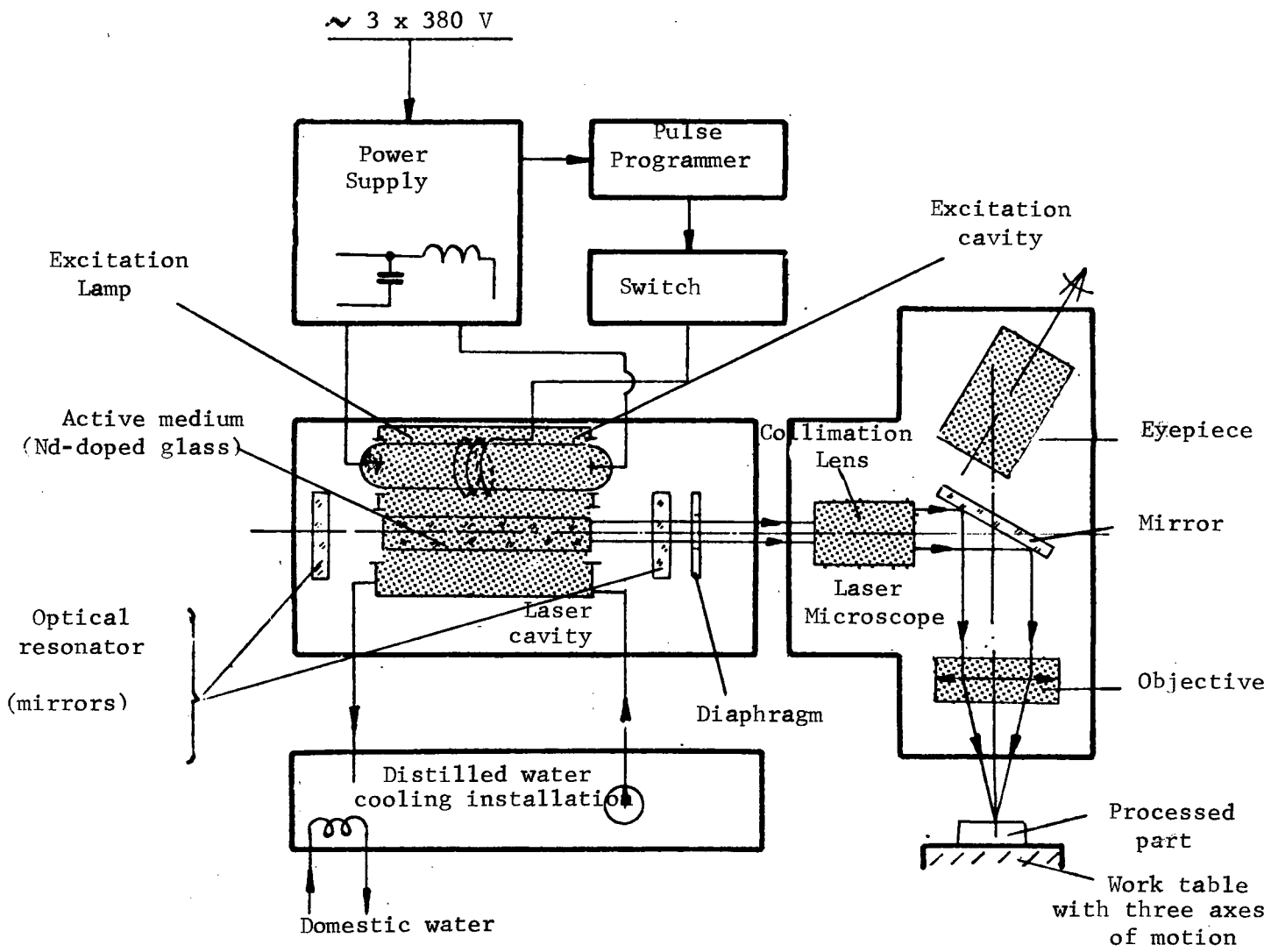

Figure 5. Block diagram of the LASEROM-01 laser processing installation.

Number of pulses: In continuous operation (manual): any number
In programmed stop operation (automatic): 1 - 9 pulses
or any number of pulses (within the operating safety limits of the laser device)
Pulse repetition rate (continuously variable): 2 - 180 s
Distilled water cooling system: closed circuit distilled water, cooled with domestic water
Installed power: 1.3 KVA

A diagram of the installation is shown in figure 6.

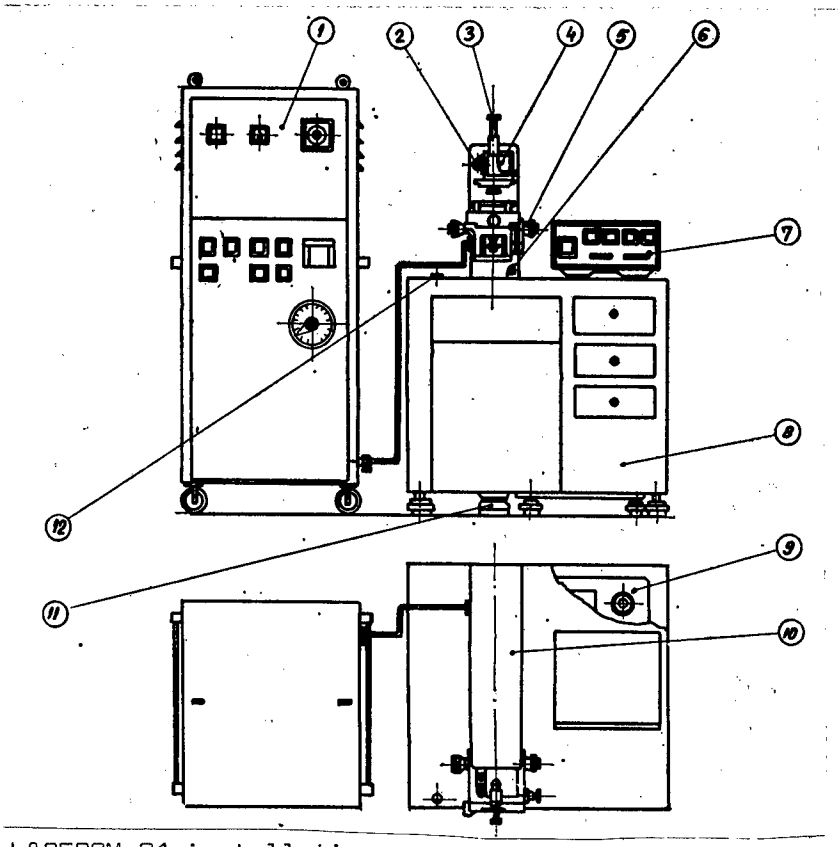

Figure 6. LASEROM-01 installation.

Key:
1. Laser power supply
2. Optical focusing
3. Optical viewing of work piece
4. Collimation system for laser radiation
5. Work table with three axes of motion
6. Pulse switching circuit
7. Pulse programmer
8. Bench
9. Distilled water cooling for laser head
10. Laser head including excitation cavity and optical resonator
11. Control pedal
12. Manual control button

The electrical and electronic portion of the installation (1, 6) consists of the excitation lamp with the pumping energy required to generate the laser, and which is delivered in the form of pulses whose energy, amplitude, duration, and number can be varied. The power supply is provided with a rectifier for a continuously variable voltage, and for charging one or several capacitors. The capacitors are discharged through the excitation lamp manually by means of a button, or automatically through the pulse programmer (7). The laser generates a beam (10), which is collimated (4) and focused (2) on the surface of the work piece.

The laser is focused through two interchangeable objectives of different focal lengths, depending on the nature of the required processing. The work piece is attached to the work table (5) with devices suited to its shape and the processing required. The surface to be processed is viewed through a microscope eyepiece (3), both for positioning and for observing the progress of the process. The distilled water cooling installation (9) assures the optimum operation of the excitation lamp and of the active medium. The installation can weld and drill at dimensions of 0.010 - 0.800 mm, and depending on the diameter of the drilled holes, to depths of up to 3 mm (4 mm max.) in hard materials.

As with any new product, installation, or process, an economic analysis of the profitability of its introduction into production is very important, keeping in mind that because of their particular importance to the national economy, it is also possible to accept special products such as a laser installation, which have a positive and decisive influence on other processes used to obtain material goods.

Considering these points, as well as the currency savings which can be obtained by using the LASEROM-01 installation, we list the advantages which can be derived from this process:

1. The possibility of drilling very small blind and through holes in hard materials;

2. The thermally affected zone is practically negligible;

3. The possibility of processing fragile materials, since the laser does not exert physical force on the part;

4. The amount of laser energy can be controlled very accurately during processing;

5. The productivity of laser processing is very high; under automatic conditions it can achieve results which are not encountered in the more traditional processes (600 perforations/hour);

6. The laser beam can be introduced through windows into gas-filled or evacuated chambers for more precious products; it is chemically pure and does not create the danger of contamination during processing.

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GREATER USE OF HYPNOSIS IN OBSTETRICS URGED

Maribor 7D in Slovenian 24 Feb 77 pp 52-53

[Text] Six months ago the Department of Gynecology and Obstetrics of the Kranj General Hospital, renowned throughout Yugoslavia as well as abroad for its perfected method of childbirth under hypnosis, successfully introduced use of hypnosis for hemiphlegics--persons who are partly paralyzed because of stroke. Hypnosis has been so far successfully applied and tested on three patients who were able through a 2 months' program of exercising under hypnosis directed by Dr Marjan Pajntar, chief of the Obstetrics Department at the Kranj General Hospital, to increase the strength of their paralyzed muscles by a factor of 24 and at the same time improved their ability to walk. "This is shown by data processed by a computer before and after treatment," says Dr Marjan Pajntar. "Everything is graphically presented and there is no doubt about the effectiveness of hypnosis for the treatment and rehabilitation of paralyzed patients. Thus far we have very carefully studied three patients, but we are expecting even greater accomplishments. However, large scale applications of rehabilitating treatment of this kind require large investments, substantial funding, which is lacking, as well as efforts on the part of the medical and other professional personnel."

Most of the credit for the present results are shared with Dr Pajntar by professor Vodovnik and Dr Dolenc and their collaborators. The effectiveness of their work will certainly improve if this method of rehabilitation is applied more frequently, if after rehabilitation centers adopt the experience and methods developed at the Kranj General Hospital, if the medical and other personnel in this area put in still more effort and if there is enough money for purchasing the necessary equipment--in brief, if there is enough understanding on the part of our society.

Deliveries

The use of hypnosis in childbirth, which is becoming increasingly more widespread throughout the world, is hardly being used in our country. The work of the Kranj gynecologist Dr Marjan Pajntar who is the past 14 years assisted at more than 1,000 deliveries is an exception in this respect. At the Kranj General Hospital where he is chief of obstetrics, more than 2,500 infants have been delivered under hypnosis.

Dr Pajntar daily receives requests by women from all over the country to be admitted to his hospital for childbirth under hypnosis. The results obtained so far clearly show the advantage of this method: In most cases women feel no pain during childbirth; they sleep quietly and follow their doctor's instructions. On the other hand the method is absolutely harmless for both mother and child.

"At first we were using hypnosis to reduce the pain of women at childbirth. Now we are using it to reduce the emotional tension. In our maternity ward deliveries are completed almost in record time. Women giving birth for the first time require 4.5 hours while those who are giving birth for the second time or more require 2.5 hours which is 3.5 hours on the average," says Dr Pajntar. "We adhere to the principle that a pregnancy must come to term timely because waiting for spontaneous delivery often results in delays. Also important is that women who are about to give birth are in good shape physically and that their obstetritician actively follows the delivery, detects any complications that may arise and takes timely action to prevent their onset, and follows up on the physical condition of the new born infant. In more than 40 percent of cases the women expecting a child come to the hospital at, say, 6:00 am and give birth on the same day before noon. It is very important that women who have already lost the amniotic fluid go into labor within 24 hours. This reduces the number of postnatal infections of infants and at the same time reduces the mortality at childbirth.

Fear

A short time ago when I entered the waiting room of the Kranj Obstetrics Department there were several women before Dr Pajntar's office waiting for their training in childbirth under hypnosis. I asked them how they learned that this method was used in the Kranj General Hospital. One of them even came from as far away as Osijek upon learning about childbirth under hypnosis from her friend, who gave birth to her child at Kranj with much ease as if there were nothing to it.

"My friend told me that her labor lasted only 1 hour under hypnosis and that she was all the time sunk into some other thoughts, answering her doctor's question, and that she felt neither fear no pain," I was told by the woman from Osijek.

When Dr Pajntar received me, he was at first somewhat sceptical about the journalists because, according to him, this kind of publicity only causes difficulties for him, particularly because some journalists were embellishing and changing his statements so that it appeared in the end as if the physician were in pursuit of fame from which, however, he reaps no material benefit. On the contrary, he must work round the clock, day and night.

"There used to be even more patients than we have now,"[Dr Pajntar reported]. "The number of maternity patients has dropped off somewhat, although I still daily receive requests for taking on new patients, which is simply impossible

for me. In this hospital deliveries under hypnosis are also performed by my colleague Dr Lavric, but the two of us are not enough to take care of all the requests."

Dr Pajntar then proceeded to tell me that the professional literature refers to the use of hypnosis for childbirth as early as at the end of the last century but that it was subsequently forgotten. It was only in 1914 that the method was again being applied. He continued: "In our country we began to introduce hypnosis at childbirth 15 years ago. Because no one believed in it before that time, it was considered unscientific and practically on the level with performances of magicians in circuses. However--and this is what really upsets me--when the physicians saw that there was in face something to it, rumors began circulating that hypnosis is harmful. Of course, it could be harmful if it were applied by persons with no experience. But what we and many others are doing is intended to prevent fear and emotional stress; there is no danger at all. Childbirth is not only a physiological but also a psychological experience. With hypnosis we direct the women's thoughts to other matters thus relieving her of pain."

Training Sessions

Of course, such childbirth is still not a simple matter. Preparations are necessary and women must come to see the physician for a few "training sessions." Approximately 5 hours of preparation are necessary for each patient.

"At these sessions I talk with the maternity patient without using the classical hypnosis at all," [Dr Pajntar explained]. "I do not look at the patient with my eyes, I only quietly tell her and suggest to her what she must do and what she must think about. After this she is ready for the onset of labor. When she comes to the examining room I address her in a low voice. Her link with the outer world becomes narrower and she has contact only with me. She is aware that she is giving birth, but at the same time I am diverting her attention from pain. Mothers who have given birth then say that they hardly felt any pain. In addition, labor under hypnosis is shorter than usual.

"However, although experts throughout the country have for some time been acquainted with the Kranj General Hospital's method, no other medical institution in Yugoslavia has so far decided to make use of hypnosis. In a few places and for a limited time only, they began to introduce this method at childbirth, but because it requires a great deal of effort and the physician's time, it was gradually forgotten, so that it is now used only in very few places.

"The door to the Kranj hospital is open to all if at all possible. The present results confirm this. And if we succeed in perfecting the rehabilitation treatment of paralyzed persons by hypnosis, this will represent yet another step forward in the medical application of hypnosis."

Gratitude

One of the rare physicians who use hypnosis at deliveries is the young physician Dr Ljiljana Mustapic-Jurisic, who was until recently practicing in Trbovlje and then went to Rijeka. Because this method was not in use at Rijeka and she herself does not have the appropriate facilities, she intends to return to one of the Slovenian hospitals.

I heard about this young physician and her accomplishments in application of hypnosis at childbirth by accident from a young mother from Hrastnik who proudly said that she would also have her second child delivered under hypnosis by Dr Ljiljana Mustapic-Jurisic.

"It may be a better idea to discuss hypnosis with docent Dr Pajntar and my colleague Dr Majda Pust, who is practicing in Trbovlje, with whom we together began using hypnosis at childbirth," says the young physician. "We took a course from Dr Pajntar. I must say that we had very good results. He gave us a tremendous amount of help in introducing us to this work. In 5 years at Trbovlje I helped more than 50 maternity patients with hypnosis who later said that their labor was without difficulty and pain. I think it is a pity that other hospitals are not introducing this method which is easier for the patient but demands more time and effort on the part of the physician. Because I have no opportunity in Opatija for continuing with this practice, I shall probably soon return to one of the Slovenian hospitals because I am interested in the application of hypnosis for other purposes, too."

According to her, this work is based strictly on scientific foundation, although many people have reservations with respect to application of hypnosis in medicine.

"Hypnosis is some kind of trance," [continued Dr Ljiljana Mustapic-Jurisic]. "The woman in labor becomes completely relaxed both physically and psychically and can in this state cooperate extraordinarily well with the obstetrician. Of course, it is necessary to go through considerable training in which the patient learns to obey the instructions and relax. Only 5 percent of all people cannot be hypnotized. The reason is well known: subnormal intelligence. Of course, it is also impossible to hypnotize a person who does not want to be hypnotized. Maternity patients showly become accustomed to this kind of trance and relaxation and later, when they are in labor, have no difficulties in cooperating with the physician. Every week they have one 'training session' to practice a specific exercise.

Hypnosis Against Smoking

"A maternity patient is told, for example: 'Now you will put on your shoes, go to the end of the hall, enter the last room on the left where you will find a vase with flowers; you will take the flowers and bring them to me.' It is the duty of the hypnotizing physician to explain to the patient all details of his future trance. During the hypnosis, too, the physician instructs the patient what to do. He must speak in a low voice and recount

what will happen. For example: She will be given an injection; then we shall feel out the position of the child; when labor contractions will occur; and how she should help. The woman listens without objection in the hypnotic semi-trance. She can ask for water and drink, but all this is done under hypnosis. When the mother is told at the end that she gave birth to a sone or daughter, she smiles while still under hypnosis and the trance continues until I tell her to wake up."

Nowadays it is no longer a secret that it is possible to stop smoking, using alcoholic beverages to excess, or become weaned from other harmful habits with the help of hypnosis. Particularly good results were lately obtained in medical practice by using hypnosis at treatment.

"An effort was made to cure the so-called potential miscarriages of psychologically unstable women," [the doctor added]. "The results of hypnosis were extraordinarily good. The method of semi-trance can also be used in dentistry for both adults and children. Hypnosis is very useful in other branches of medical practice, too."

This young physician had, for instance, a case where a maternity patient prematurely got labor pains and immediately came to the hospital. The examination, however, showed that she would give birth no sooner than the next day. The physician told the patient: "Now you will fall asleep and you will wake up only tomorrow when I come to see you." The woman then slept until the physician came and was thus perfectly rested and relaxed before she went into labor.

Dr Ljiljana Mustapic-Jurisic attributes all her experiences and achievements in this field to the leadership of Dr Marjan Pajntar, who blazed the trail in the area of childbirth under hypnosis and was not stingy in transferring his knowledge to all those who were willing to improve themselves by perfecting their knowledge. Unfortunately, the facts show that use of hypnosis in medical practice still has not received proper acceptance and recognition in our country.

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DELO INTERVIEWS RESEARCH, ENERGY SPOKESMEN ON NUCLEAR ENERGY

Ljubljana DELO in Slovenian 9 Apr 77 p 24

[Report on interview with Dr Milan Osredkar and Drago Petrovic, presidents respectively of the Slovenian republic committees of research and energy resources, by DELO reporters and editors; time and place not given.]

[Text] Nuclear energy, which is more closely than any other form of energy related to a high degree of technological development and large investments, has reached a degree of development at which individual countries possessing nuclear expertise are attempting to maintain and preserve their monopoly on a global scale. This holds especially for the most powerful countries in the so-called London nuclear club, and especially for the United States and the Soviet Union. How are we in Yugoslavia planning the development of nuclear energy in view of these problems? What is the role of Yugoslavia in the alliance of nonalined countries for protection of the raw materails basis and for the pooling of their technological and mental capabilities and know-how in the area of nuclear energy?

These were question raised with Prof Dr Milan Osredkar, president of the Republic Committee for Research and Drago Petrovic, president of the Republic Committee on Energy Resources, by editors and reporters of DELO: Slavko Fras, Tit Vidmar, Bozidar Pahor, Andrej Novak, and Zeljko Kozinc. The article has been prepared by Zeljko Kozinc.

DELO: What is the place of nuclear energy in the Yugoslav energy resources development planning?

Petrovic: In 1975 Slovenia generated 6,200 GWh of electrical energy. According to estimates its total production and purchases will grow to 9,600 GWh by 1980, to 16,500 in 1990 and to 29,000 in the year 2000, which means that it will increase by a factor of 25. We expect that nuclear energy will provide 11 percent of the total generated power in 1980, 15 percent in 1990 and 30 to 40 percent in the year 2000.

In 1980 Yugoslavia will require 67,000 GWh, 138,000 in 1990, and 250,000 by the end of the century, which will be approximately six times more than in 1975. It is expected that by 1995 electric power plants with capacity of 4,000 to 7,000 MW will be using nuclear fuel. The first nuclear powerplant

is jointly owned by Slovenia and Croatia; the second, with capacity between 800 to 1,000 MW, will likewise be Slovenian and Croatian and will be located somewhere in Croatia; the third, with rated power of 1,000 MW, will be somewhere in Serbia, while no decision has yet been made about the fourth and fifth plant.

DELO: What are the possibilities for utilization of other energy resources?

Petrovic: The still available hydroelectric power potential in Slovenia would allow generation of 3-4 billion kWh per year. This would require a chain of cascade hydroelectric powerplants on the Sava and Mura rivers, additional dams and powerplants that could be built on the Soca River and some other rivers, and powerplants that could be built on some of the smaller streams. The total hydroelectric power in Yugoslavia amounts to 45 billion kWh of which, however, only one-half can be utilized. This refers to the as yet unharnessed areas of the Drina River and Sava River and their affluents.

DELO: Do not oil and gas also constitute an energy resource for generation of electrical power?

Petrovic: In the future oil will be used as a petrochemical raw material rather than fuel. Its use in electric power plants, especially, will be deemphasized. Moreover, Yugoslavia has only very modest resources of oil and natural gas. If our energy consumption were confined predominantly to these two resources, we would become dependent on increasingly more expensive imported energy resources. The problem of dependence on energy resources has not yet received much study in Yugoslavia but the problem nevertheless exists. In Slovenia alone we import over 50 percent of our energy, while Yugoslavia, as a whole, imports not less than 40 percent of its energy. This shows that we have fallen behind not only in the utilization of our own primary energy resources but also in exploration of these resources. Therefore one of the basic requirements of our long-range energy resources policy is development of domestic energy resources on one hand and very efficient and rational use of imported energy on the other. This completely rules out extensive use of natural gas or oil products in electrical power plants. The energy resources available for electric power generation are and will remain: coal, the as yet unexploited hydraulic power and nuclear fuel. We should not forget here the new technologies--geothermal, solar, wind, and nuclear fusion--which, however, will according to our estimates not represent a significant part of the electric power generation until at least the year 2000, not to speak of the economically efficient application, which will come much later. For the present our energy planning must remain on the already mentioned threefold basis. We were of the opinion that Yugoslavia must show great interest in nuclear technology not only because we have been for many years developing nuclear technology and forming the scientific cadres in this area but also because certain regions in Yugoslavia will have to depend on nuclear energy because of the relative scarcity of their energy resources. This holds particularly for Slovenia.

DELO: Do we have enough nuclear fuel reserves for pursuing the nuclear option?

Petrovic: The presently known nuclear fuel resources are estimated at 10,000 tons, most of which is in the Zirovski Vrh uranium mine. According to some estimates the available resources may be increased to 36,500 tons. The estimates are low because the prospecting was not extensive. Securing of adequate quantities of nuclear fuel will certainly be one of the basic problems for the implementation of the nuclear program.

DELO: What are the other problems?

Petrovic: The second problem is selection of the nuclear technology and reactor, the third siting of the nuclear power plant, and the fourth integration in the energy distribution system and size of the units which, according to some estimates, should not represent more than 6 to 8 percent of the total installed power of the system when they are placed on line.

DELO: How much nuclear fuel will the first three nuclear powerplants use?

Petrovic: If we consider that the first three nuclear powerplants will have a total rated power of 2,500 MW they will require 18,000 tons of uranium concentrate for 30 years of operation. The presently known resources of Zirovski Vrh and resources expected from the intensive prospecting elsewhere will only suffice to cover the needs of two electric power generating plants. For this reason it will be necessary to thoroughly explore all possible uranium deposits in Yugoslavia; otherwise we shall be forced to import the fuel. The problem of importing fuel is becoming more acute every year, particularly after the rapid increases of oil prices when a number of countries definitively opted for a nuclear energy program. Since 1970 the price of uranium increased by more than 400 percent. We have secured the first charge for our nuclear powerplant, but we are having great difficulties in finding the second and the third charges. The supply of enriched uranium is extremely small. If we do not develop a domestic supply of nuclear fuel we shall probably have to seriously approach the question of other solutions.

DELO: Are we not planning to set up uranium enrichment plants?

Petrovic: We have a long-term contract with the Americans for the enrichment of uranium after we deliver to them our uranium ore processed into the so-called yellow cake. For the present we have no intention to build uranium enrichment plants, because such installations are extremely demanding and very expensive.

DELO: Does this, translated in political parlance, mean that we could be left without a single nuclear kWh if the Americans so decide?

Osredkar: The British and the French also have some enrichment capability, but they are using it for their own military needs. Commercial enrichment of uranium in Europe will become available only after 1980 when the

Eurodif plant, founded at the urging of France by some European countries, will become operational. For the moment, however, we are forced to have our uranium enriched either in the West or in the East.

DELO: For its first nuclear power plant Yugoslavia decided on the so-called light water reactor which requires enriched uranium. Why have we decided for this type?

Osredkar: The decision was made on the grounds of economy and reliability. There are some 100 reactors with light water and enriched uranium in the world. The majority of operating reactors, including the German, Italian and Soviet ones, are of the same type as the reactor which the Americans developed for the submarines. It was precisely with these reactors that Westinghouse acquired its expertise so that it could enter the market with a developed product.

Petrovic: The American reactors with light water have penetrated the world market with extraordinary success. Moreover, it is a fact that the reactor that is presently being installed at Krsko has been tested commercially and, as already mentioned, has been installed in a series of electric power generating plants and tested under operating conditions which required solution of operational technological problems. Also decisive in selection of the Krsko reactor were its reliability of operation and a high degree of security with regard to environmental protection.

DELO: It would probably be most economical if other nuclear powerplants utilized the same technology, although, on the other hand, this may not be the most prudent choice for strategic reasons because it would make us dependent on a single source.

Petrovic: The selection of the technology and the type of reactor for the next nuclear program is certainly a most important problem. In choosing the type of reactor we shall also have to consider the concept of our industrial development and the possibility of domestic production of nuclear equipment. In the construction of the first nuclear plant the contribution of domestic industry was relatively modest. In fact, it was only a token participation. Compared with $140 million worth of imported equipment, only $12 million will probably go for domestically produced equipment. This is an indication that we have, in our preparations, somewhat neglected the concept of integration of our domestic industry, particularly in the area of equipment supply. In the future we shall have to determine, in addition to selecting the reactor, the minimal level of participation by the domestic industry which will ensure its capability to improve its mastery of nuclear tec-nology. In constructing their nuclear power plants, all the developed countries insisted that the participation of their domestic industry be as large as possible. In France, Westinghouse has set up a subsidiary and the French domestic participation in the construction of their first nuclear electric powerplant was no less than 40 percent.

Osredkar: We also were not as successful with our domestic participation because of the rapid pace of construction. The Krsko nuclear power plant will be completed in 54 months. We expect that it will be completed in 1979 which means that it will be built in record time. Why did we decide on such a short time and on a turnkey contract? The reason is the serious energy crisis which we can overcome only with a large electric powerplant. No matter how many hydroelectric powerplants we built on the Sava River, our problems in the present energy crisis would not be solved. If we insisted on greater participation of our domestic industry in construction of the Krsko electric powerplant its construction would be delayed for 2 or 3 years. Although our industry is capable of producing a whole series of pumps, valves, turbines, and the like it would require some time to do it. By purchasing American processes, plans and instructions we could buy a great deal of our energy independence, but because of the time delays involved our energy crisis would be further exacerbated. This is why preparation for our second nuclear powerplant should begin at this very moment, so that time may be gained for the domestic industry, which is certainly capable of producing many parts for the equipment of nuclear electric powerplants.

Petrovic: Our contract with the Americans specifies that at least 15 percent of the equipment will be supplied by us. Eventually less than 10 percent of the installed equipment will be of our own manufacture. On the other hand, we are installing 42 percent of the total value of equipment in the Sostanj thermoelectric powerplant, which means that we could supply considerably more of our own equipment to the Krsko nuclear electric powerplant if our industry were better prepared and organized.

Osredkar: It would be very profitable if we did our own design, organization, and engineering. Moreover, we would in this way obtain incomparably greater experience. Our objective in this as well as in all other large investments of this kind is to deemphasize the turnkey arrangements and to carry on with our own engineering enterprises.

Petrovic: In Krsko it became apparent that our construction enterprises are very effective. The Americans have on several occasions publicly stated that they would be willing to use construction enterprises such as Gradis and Hidroelectra on their projects anwhere in the world.

DELO: How will the important problem of nuclear power plant siting be resolved in Yugoslavia?

Petrovic: The basic conditions of environmental protection and the requirement for cooling water must be fulfilled. The cooling requirement for nuclear electric powerplants is, by 50 percent, larger than that of coal burning thermoelectric powerplants. This raises the threat of thermal pollution, especially in places where a flow-through system is used on rivers. Because rivers in Yugoslavia have rather limited flow, the possibilities for flow-through cooling is relatively small. Solutions are to be sought in two directions: in the recycle cooling system which requires 20 times less water than the flow-through system or in siting the powerplant at locations on

the sea coast. These two solutions are used throughout the world. In Krsko we shall use a combined system of recycle and flow-through cooling. I would like to mention another problem--the characteristics of nuclear electric power generating plants. A nuclear electric powerplant must of necessity operate as the basic generating plant of the system, because energy from this plant cannot be used for supplying only the demand occurring at the time of peak loads but rather for supplying a steady demand. Placing a nuclear electric powerplant on line and taking it off again is an expensive process. This is why introduction of nuclear powerplants is feasible only after the energy distribution system has attained a certain size. In absence of large users such as the chemical industry and electrolytic plants, that is, users who have a continuous need for energy, a nuclear electric powerplant is uneconomical. This is why in our country the need or rather the possibility for introduction of such large basic energy supply units appeared only at a given point on the growth diagram of electric power consumption.

DELO: During construction of the Krsko electric powerplant considerable cost overruns occurred. What was the reason for it.

Petrovic: The first bid did not account for the full extent of all the plans and changes made during construction.

During construction it turned out that the banks of the Sava River had to be protected, that additional requirements of the seizmologists had to be taken into the account and the like. This and other factors caused the cost of the nuclear power plant to increase from the originally estimated 750 billion old dinars to 1,250 billion old dinars. The cost of fuel, too, has increased. A pound of fuel, that is, somewhat less than one-half Kg, that cost $14 at the time when we purchased the first fuel charge, costs $40-$45 at present. A full charge weighing 120 tons thus costs $22 million under our contract. Each year one-third of the charge is replaced.

DELO: In view of this what must our foreign nuclear policy do with regard to the monopolies presently existing in the world and the possibility that we may organize in a different way. What are these possibilities?

Osredkar: A similar situation as in Yugoslavia exists in many other countries. In the first place uranium ore deposits have not yet been fully explored. Accordingly, one of the basic needs of the nonalined or undeveloped world is finding the way for discovering their natural resources for later use.

At the Colombo conference, mutual agreement on cooperation between nonalined countries was adopted as a guiding principle also in this area. I feel that the situation demands that Yugoslavia establish close ties with friendly countries and, in a joint action, secure for them as well as for ourselves the resources which we do not have at home. We have already taken the initiative for concluding such agreements. At the last International Atomic Energy Agency's conference in Rio de Janeiro, Yugoslavia proposed that the agency's secretariat undertake a study which would investigate from the organizational,

economic, financial, legal, and technological aspects the possible ways in which groups of countries could form alliances that would provide mutual assistance both in acquisition of the raw materials and dissemination of know-how as well as in securing financing. This idea was very well received and will have to be developed further as one option for Yugoslavia, suitable primarily within the framework of the developing countries. Although the study will be carried out by the agency, the action will have to be implemented within the framework of Yugoslav foreign policy jointly with other nonalined countries regardless of the agency.

DELO: How do you assess the practicality of translating these plans into action in view of the obvious pressure that is brought to bear on the part of the monopolist tendencies?

Osredkar: There are opportunities for all who can invest their time and effort. We know, for example, that the Indians developed their own fuel processing and separation of plutonium and, moreover, that they exploded a nuclear device of their own make. The Chinese, too, surprised the world by developing the uranium enrichment process and constructing the bomb.

DELO: Are we thinking of which countries possessing the raw materials and technological expertise would be suitable for actual cooperation?

Osredkar: India is certainly one of the countries that would be of interest for cooperation. However, the Yugoslav nuclear program has not yet advanced far enough to permit discussion of specific proposals with others. The previous nuclear commission was abolished. The new commission has already begun to consider these matters. It is concerned with the domestic nuclear development programs, but there are still numerous problems left to be considered.

DELO: What can we Yugoslavs offer to an alliance of nonaligned countries in the way of scientific or research contribution:

Osredkar: Many things. Let us begin with the mineral research which Yugoslavia successfully conducted abroad, especially in the Arab countries. We certainly have a lot of capability and experience for this kind of work. Likewise we have a great deal of knowledge of the uranium concentration in uranium ore which we gleaned during our investigations at Zirovski Vrh. Many people have been trained at the pilot uranium ore processing plant in Gorenja Vas which has been operating for 15 years. These people can now apply their know-how at similar operations abroad. Likewise we have many people who are concerned with heat transfer problems and groups of people who were concerned with the safety problems in nuclear electric plants. The safety report for the nuclear electric powerplant at Krsko was prepared in its entirety by the Jozef Stefan Institute with cooperation of experts from Zagreb and Vinca. The report consists of 14 thick volumes. Although this is a well established procedure in use at all nuclear installations, it also is very much needed in other industrial undertakings as has been demonstrated by the Italian Seveso. We could contribute expertise in this area, too.

DELO: What opportunities have our people had so far for broadening of their knowledge?

Osredkar: The opportunities were rather meager. We had neither a program nor funding for development and marketing of expertise. These things cannot be accomplished on short notice, but our long range programs have been allowed to come to a complete standstill. This precarious situation is compounded by the fact that we have fierce competition on the international scene. It is difficult to compete in a situation where one is not in position to offer special financial inducements. This is why we have been pushed aside by those who could offer such inducements. Thus, for instance, the Egyptians requested the French to provide them with an analysis of possible sites for nuclear power plants. A similar request was made of the Germans by the Persians.

We have not been very active in the area of fuel processing because the laboratory equipment at Vinca was dismantled. In Ljubljana, however, there is a fluorochemical research group which concerns itself with the chemistry of uranium. To sum up, we certainly have the capability for international cooperation; we are not empty handed although, for the present what we have to offer may not be a very large scale operation. For the start, however, what we have is enough.

DELO: How do you feel the organization and encouragement of our research activity and expertise in this area should be handled?

Osredkar: In the area of nuclear technology we should first of all endeavor to see that what we have does not stagnate. When the long-range program for the development of nuclear energy in Yugoslavia [was suspended], the research workers, of whom there were quite a few, and good ones at that, in our nuclear institutes redirected their interests to other research. While there was nothing wrong with this, because their new research was by and large very important, it did result in a decrease of nuclear research. Now it will take considerable effort to set up a new, well-planned, long-range program which will again make possible development and expansion of professional expertise which develops the know-how in this field. A program like this, however, requires money. We also would need an influx of fresh research workers and experts which, however, is impossible without a realistically conceived long-term program.

Petrovic: We certainly have potential for research but a certain time is required before it can be activated. If we are going to cooperate with the nonalined countries in matters of technology and professional personnel, seek mutually advantageous solutions, share the work on large projects and pool the forces and resources needed for achieving projects of such magnitude, it should be expected that many hitherto somewhat hidden and not fully utilized research capabilities will be reactivated. On the other hand, we should realize that the present situation again makes it imperative that we take intensive interest in nuclear technology simply because of the

developmental needs and the situation in which the world has found itself. A series of developing countries is faced with similar problems. The antagonisms between the countries which have mastered nuclear technology and which are trying to monopolize the development of this technology in the less developed countries are such that there is ample opportunity for us to cooperate in the transfer of technology. The antagonisms in the London nuclear club should be exploited from the technological, organizational, and staffing aspects. We must formulate at the earliest possible time our long-range strategy with respect to nuclear technology, not only in Yugoslavia but also in the entire nonalined world.

Osredkar: If we want to play a role of any consequence in alining the nonalined countries we must be prepared to pay the price. This is another reason why the long range program of nuclear energy development should be reactivated. The period of stagnation and, in part, of apathy when it was felt that working on these problems was useless since we were going to purchase all the equipment anyway, must end. The situation today is different. We must rid ourselves of the old views on the development of nuclear power, because they impede our economic and political development.

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